

(No Model.)

4 Sheets—Sheet 1.

C. L. GOULD.

METHOD OF OPERATING STEAM SHOVELS AND DISPOSING OF EXCAVATED  
MATERIALS, AND APPARATUS FOR CARRYING OUT SUCH METHODS.

No. 506,908.

Patented Oct. 17, 1893.

Fig. 1.

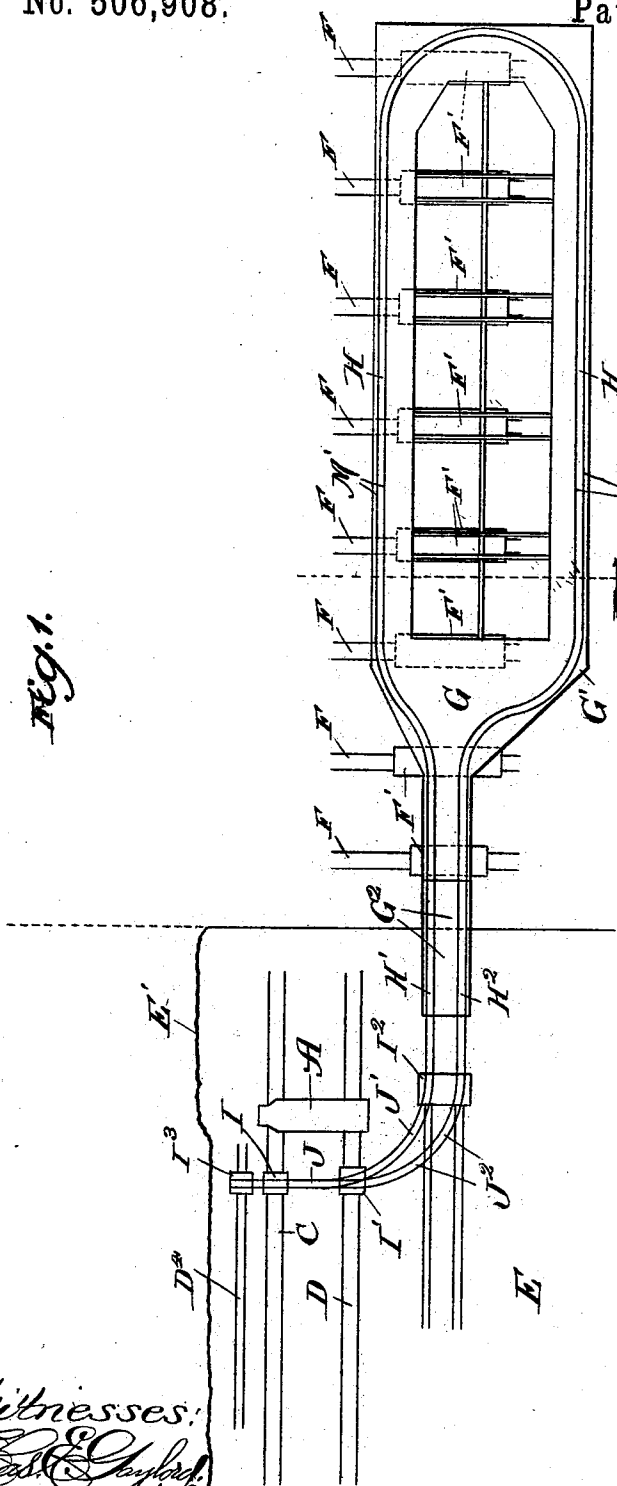
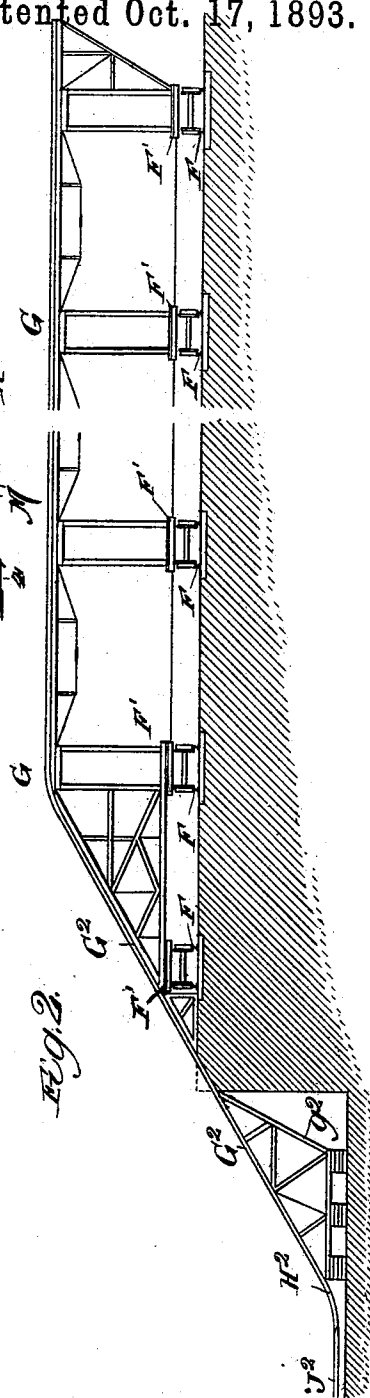


Fig. 2.



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(No Model.)

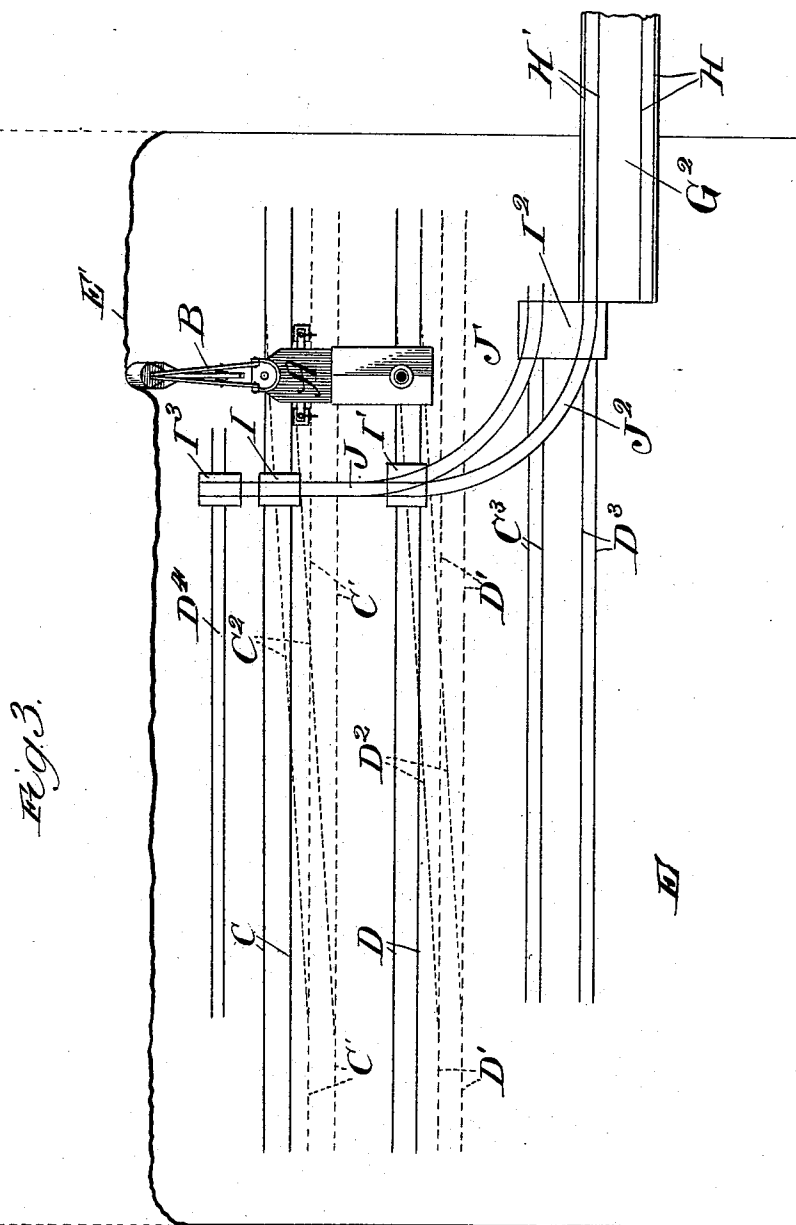
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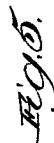
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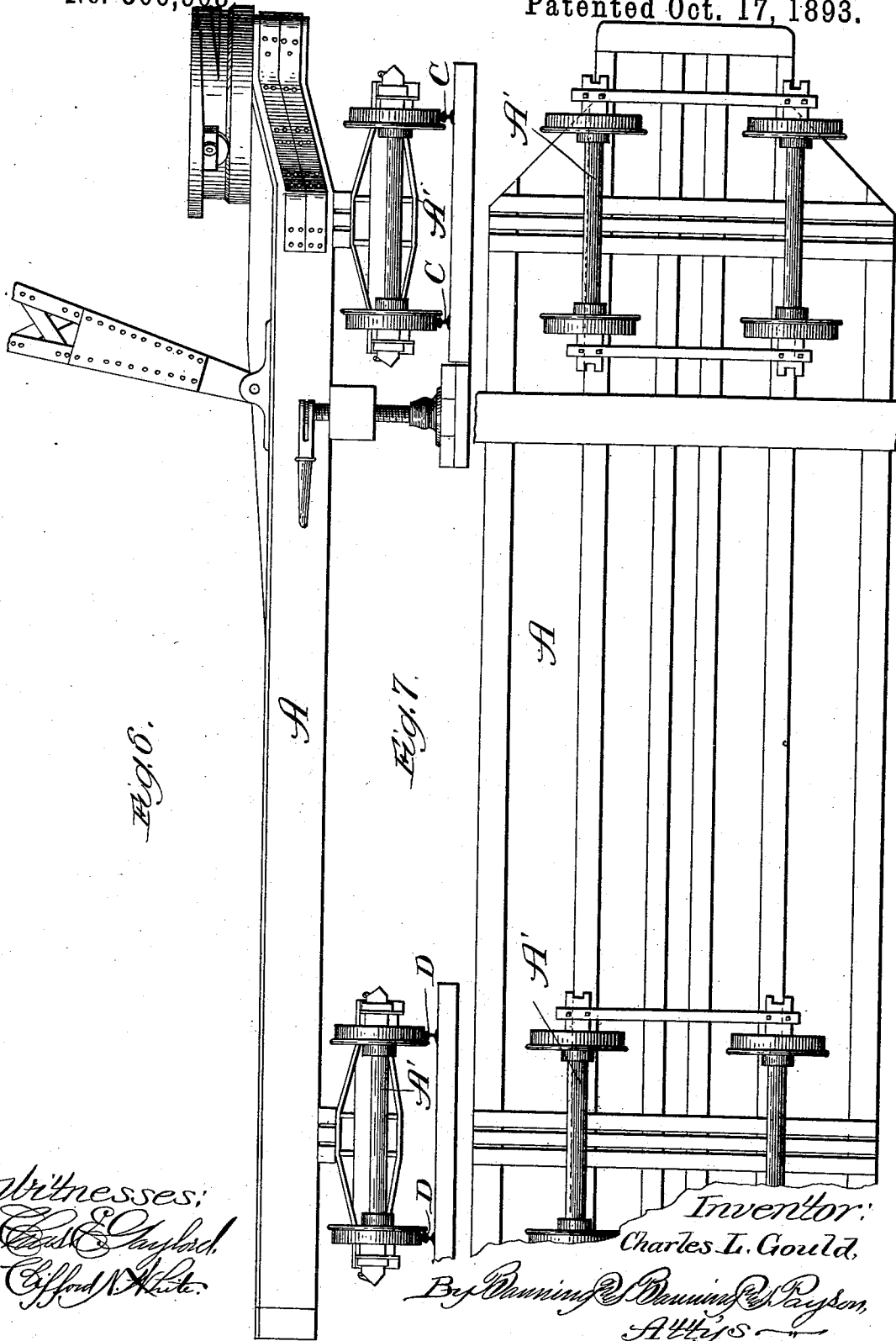
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No. 506,908

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# UNITED STATES PATENT OFFICE.

CHARLES L. GOULD, OF CHICAGO, ILLINOIS.

METHOD OF OPERATING STEAM-SHOVELS AND DISPOSING OF EXCAVATED MATERIAL AND APPARATUS FOR CARRYING OUT SUCH METHOD.

**SPECIFICATION** forming part of Letters Patent No. 506,908, dated October 17, 1893.

Application filed February 28, 1893. Serial No. 464,069. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES L. GOULD, of Chicago, Illinois, have invented an Improvement in Apparatus for Excavating and for Disposing of Excavated Materials, of which the following is a specification.

In this specification I use the term "excavator" to include only that type of excavating apparatus commonly known as a "dipper excavator" in which a swinging crane is employed, the jib of which crane carries and operates a rigid handle secured to and capable of directly communicating thrust to a dipper; so that the machine is often called in this country a "shovel," and when operated by steam, a "steam shovel," though I do not intend herein a limitation to operation by steam. In "through cuts," *i. e.*, in cuts having two sides, and in the initial stage of the excavating operations, always one closed end, or transverse face, and sometimes, as in isolated sections of a canal, two closed ends, or transverse faces, excavators (using now and hereinafter the term excavator to apply only as previously indicated) have heretofore in wide excavations first cut a "gullet," *i. e.*, advanced a portion of the transverse face, and then by repeated cutting along the side or sides of the gullet have widened the cut as desired. The method in advancing the portion of the transverse face is to move the excavator along a track extending longitudinally with the cut, and to work the excavator head on and excavate in the transverse face; and, because the track on which the cars are loaded can extend freely at one end only, the cars must be uncoupled and one at a time be set in to and taken out from alongside the excavator in order that they may be loaded. The method in widening is to move the excavator lengthwise of the previously excavated "gullet" and excavate along its side or sides, and admits usually of the track parallel to that upon which the excavator stands being freely extended in both directions, so that an entire train can be loaded by the excavator without uncoupling the cars one from another. Thus two distinct methods of operating have been necessary in making by excavators cuts of great width, involving repeated travel of the excavator back and forth on tracks extend-

ing longitudinally with the cut. These methods are subject in many cases to serious practical disadvantages. For example, in the case of an isolated through-cut section of a canal when ground for spoil bank has been provided alongside of and co-extensive with the cut, in order to obtain the shortest haul the material excavated and loaded into cars must be forwarded to the spoil bank over tracks lying transversely across the cut. Such transverse tracks and the cars traveling on them would, however, be constantly interfered with and interfere with the longitudinal tracks aforesaid and with the cars traveling on them; and this difficulty would be aggravated by whatever movements the excavator makes back and forth on its longitudinal tracks in widening the cut. These longitudinal tracks for the shovel and for loading have, therefore, induced the practice of forwarding the material excavated and loaded into cars by tracks also substantially longitudinal, said tracks usually climbing the sides of the cut, not directly nor usually operated by stationary power, but gradually, by grades proper for operation by locomotives, the ascent being in like manner continued without the cut until the height is attained requisite for the deposit of the material. This necessitates tracks of considerable length, consumes much time in moving the loaded cars to the dump and the empty cars back to the excavator, involves great expense in shifting these tracks, in order that the dumping of the excavated material may proceed, and in keeping the tracks in fair condition—especially on the newly made dumps—spreads out the work over long distances, and occasions continual change in the relation of the various parts to each other. The want of more efficient apparatus whereby the transverse face may be advanced and wide cut made at one operation, has been long and severely felt. Various means have been devised for the moving of the excavated material directly to its destination; but, the excavator has heretofore come short of operative harmony with any one of them. This being the condition of affairs and the state of this art, I set to work to discover or devise apparatus which would overcome the defects inherent in those previously used. In effecting this result, speak-

ing generally, I employ in connection with an excavator adapted to move transversely upon and across the bottom of the excavation, in a direction at an angle to its length, mechanism for removing the excavated material, which mechanism travels alongside of the excavation, ordinarily moving ahead of the spoil or other banks which it forms.

To adapt the excavator to travel transversely across the cut, while still working head on to the transverse face, I have been compelled to make various changes in the construction of the frame and trucks upon which the excavating machinery stands. I have also devised various means for receiving the excavated material from the excavator and for carrying it to the apparatus traveling without the cut. I have, therefore, an excavator working head on to the transverse face of the cut, traveling transversely at an angle to the longitudinal direction of the cut in a zig-zag manner from one side of the cut to the other, (all this in and on the bottom of the cut,) mechanism alongside and without the cut traveling in a direction parallel to the longitudinal direction of the cut, and mechanism for bringing these excavating and removing devices into operative connection. While, however, I shall describe the transversely traveling apparatus for excavating, and the longitudinally traveling mechanism for disposing of the excavated material, as operated jointly, it will be obvious that if desired they may be operated separately; since it is, of course, possible to employ the transversely traveling excavator in connection with other apparatus for disposing of the excavated material, and, similarly, it is possible to employ the longitudinally moving mechanism for disposing of material otherwise excavated. I have, however, described them together, because they seem to be peculiarly capable of conjoint interdependent action; and my invention comprises the mechanism and the various details of construction and combinations hereinafter to be more particularly described and claimed.

In the drawings, Figure 1 represents a plan view of my appliances, showing the excavator and the transverse tracks within the cut, and the longitudinally traveling apparatus without the cut; Fig. 2 a side elevation of this apparatus, partly broken away, showing one form in which it may be constructed and also one form of incline and apron extending from such apparatus down into the cut; Fig. 3 a plan view of the appliances in the cut showing the method of advancing the excavator as the excavation progresses; Fig. 4 a section on line 4 of Fig. 1, looking in the direction of the arrow; Fig. 5 a side elevation of the excavator, illustrating the method of forwarding the excavated material from the excavator to the longitudinally traveling apparatus alongside of the cut; Fig. 6 a side elevation; and Fig. 7 a bottom plan view of the trucks and frame of the excavator.

I propose, as shown in Figs. 3, 6 and 7, to arrange the propelling gear and the trucks immediately underneath the excavating machinery, in such manner that the excavator, while pointing head on toward the transverse face of the cut, shall run upon lines of rails, C and D, extending transversely across the bottom of the cut. This position of the excavator in reference to the transverse face, E', of the cut, E, is made apparent from Fig. 3, where it is shown advancing the excavation of said face. When the excavator has reached the limit of its travel in one direction, for example, the left hand side of the cut, having advanced the excavation as it crossed from right to left, it is then itself advanced into position for further excavation in the transverse face in the following manner:—Suppose the dotted lines, C' and D', to indicate the rails upon which the excavator has traveled while excavating across the cut, E, in transverse face E', and that it has reached and is standing upon the left hand end of these rails. The remaining portion of said rails are now to be shifted into the usual position of cross-overs between parallel tracks, as shown by C<sup>2</sup>, D<sup>2</sup>, providing for the advance of the excavator as it returns to the right hand side of the cut; the rails forming the cross-overs and said left hand ends to be then shifted into positions indicated by the full lines C and D parallel to and in advance of their earlier positions indicated by the dotted lines C' and D'. This is the method of advancing the excavator to follow up the transverse face, which I prefer as entirely practicable and as avoiding the use of frogs. If desired, however, the same result may be accomplished by the use, in the usual manner, of additional rails. In one or the other of these ways, by simple change in propelling gear and trucks, and by suitable disposition of tracks, provision is made both for the travel of the excavator back and forth across the bottom of the cut and for the advance of the excavator as the transverse face of the cut advances. The cross-over method may be used in any cut the width of which is sufficient to allow of the above described operation. When the cut is too narrow to permit the use of the cross-over method, other mechanism would have to be used to provide for the forward movement of the excavator. While I have shown these rails laid at a right angle to the sides of the cut, it is not essential that they should be so laid; they may assume any other desired angle, so long as all provide for the movement of the excavator across the bottom of the cut in a direction parallel to the transverse face of the cut.

Having described the manner of operating the excavator itself, I now pass on to a description of those appliances which are intended to dispose of the excavated material, describing first the kind of apparatus more particularly shown in Figs. 1, 2 and 4. In this form, I lay without and to one side of the cut

(shown in the drawings at the right hand side) any desired number of tracks, F, F, on which travel cars, platforms, or other similar constructions F', F'. Upon these I build a structure, preferably of the form shown more particularly in Figs. 1, 2 and 4. Each side, and, if desired, the end of this structure farthest from the cut, is projected out, the side next the spoil bank usually farther out than the other side, as shown at G'. It will be evident that the size of this structure can be altered as desired, and will depend principally upon the dimensions of the cut to be made and of the spoil or other bank to be formed, and upon the slope which the excavated material will take when dumped from off the structure. Two of the principal objects of this device with projecting sides and of mounting it as described, are to provide for depositing materials into spoil or other banks so far out that their slope will substantially clear the structure, and to provide for the movement of the structure to correspond with the progress of the excavation. The main spoil or other bank is provided for by the greater projection on the side or end next to it. The material dumped from any other projecting portion of the structure than that adjacent to the main bank will ordinarily be for the purpose of filling depressions and to bring the surface of the ground to the level desired for the tracks F, F, or other substructures used. At the end adjacent to the cut, this structure slopes downward at an angle nearly to the bottom of the cut, forming an incline and apron G<sup>2</sup>, with suitable framing, g<sup>2</sup>, supported on blocking or platforms moving on rollers or on wheels or in any other manner. Upon the structure G runs a track H, preferably of location and form as shown; the ends, H', H<sup>2</sup>, whereof extend down the incline and apron to the bottom of the cut, as shown. This track may be connected, wherever found desirable, by cross-over tracks, or in any other manner; and may have spur tracks leading from it for any purpose. The top, or deck, of the structure may be level, as shown; or in whole or in part be inclined at any angle whatever, as may be found desirable for moving cars, overhauling rope, or for any other purpose.

To transport the excavated material from the excavator to the apron, I provide the following mechanism:—Traveling on the tracks, C and D, are platforms I, I', and traveling on auxiliary tracks, C<sup>3</sup> and D<sup>3</sup>, is a third platform I<sup>2</sup>. Upon these platforms is supported a track J, which, on reaching the platform I', branches into two tracks, J', J<sup>2</sup>. The wheels of the platform, I, may be, if desired, of greater diameter than the wheels of the platform I'; and these, in turn, may be of greater diameter than the wheels of the platform I<sup>2</sup>; so that the tracks on these platforms slope downward from the platform, I, to the platform I<sup>2</sup>, as will be more apparent from an inspection of Fig. 5. If desired for additional

convenience or speed in loading or handling cars, a supplementary track, D<sup>4</sup>, may be employed with a platform, I<sup>3</sup>, traveling upon it, the wheels under which may be of greater diameter than any of the others. In lieu of wheels of different diameters, the inclination may be had by platform floorings of different thicknesses, or other suitable device. Upon this inclined track travels any suitable number of cars, K, K', K<sup>2</sup>. The tracks, J', J<sup>2</sup>, at their ends on or near platform I<sup>2</sup>, either abut against the ends H', H<sup>2</sup>, of the apron tracks (see Fig. 1) or are connected with them by interposed sections of track. This inclined track is made in sections, separable between the platforms, so that when necessary or desirable the platforms, may be detached one from another. When the platforms I, I<sup>3</sup>, are to be moved from one side of the excavator to the other, this is done preferably by lifting and swinging them by the jib of the crane; the platform I', being moved, preferably, though not necessarily, by hand. In Fig. 3, this inclined track, as well as the excavator, is shown advanced to a forward position of the transverse tracks, while the longitudinally traveling apparatus has not yet been moved forward so that its track ends shall register with the ends of the inclined track.

When desired, a level track may be substituted for the inclined track, by making the wheels of the same diameter and the platforms of the same thickness.

The operation of this device is as follows:—The excavated material is deposited by the excavator into the car K, standing on platform I<sup>3</sup>, or on platform I. This car is then run, by hand or otherwise, down the inclined track to the platform I<sup>2</sup>, thence by suitable power to the apron, up the apron and incline, and along the track on the deck of the structure to any desired point for dumping the material out of the car. The car, now empty, completing its journey on deck, either around the structure, or by direct return or by cross-over route, as may be chosen for that particular trip, runs down the track H' or H<sup>2</sup>; and when needed is again drawn up the inclined track, J', or J<sup>2</sup>, and J, into position for receiving another load. When a loaded car or cars are traveling down over the track J<sup>2</sup>, other cars or car can be traveling up over the track J', to be filled, or the operation may be reversed. As the excavator travels along its tracks, the platforms I<sup>3</sup>, I', I<sup>2</sup>, carrying with them the tracks J, J', and J<sup>2</sup>, are to be moved along their respective tracks, the tracks C<sup>3</sup> and D<sup>3</sup> being shifted as may be necessary in order to retain their position relative to the tracks C and D. It is evident that empty cars may be set in at the same time on platforms I and I<sup>3</sup>, and that when loaded they may travel either separately or together to be dumped and to return. When the excavator is working in a position so near to the side of the cut, that by reason of the platform I<sup>2</sup>,

abutting against the apron, the platforms, I, I<sup>3</sup>, are too far from the excavator for the loading of the cars standing upon them, said platforms I, I<sup>3</sup>, with the sections of the track and the empty cars on them, may be detached and moved along the tracks C and D<sup>4</sup>, to within reach of the swing of the jib, and when the cars have been loaded, the platforms may then be moved back to their usual position and the loaded cars on them forwarded to the dump, the excavated material when dumped not interfering with the short sections of track upon which the structure with projecting sides stands nor with the structure itself. When low ground is encountered, enough excavated materials are dumped from that portion of the track which runs along the forward side of said structure, to fill the depression to a proper level for extending the tracks, F, F, by sections added thereto, all this preliminary to further advance of the structure to keep pace with the progress of the excavation of the transverse face of the cut. When desirable a greater projection may be given to the forward side of the structure, and a less projection to the rearward side. Clearly, this longitudinally traveling apparatus provides for easily maintaining an excellent track for the transit with speed of excavated materials, and a dump always clear and unobstructed, ready at all times for fresh additions thereto; it dispenses with the usual tracks on dumps along which the excavated material travels in its transit from cut to fill, eliminating in the most radical manner the heavy expenditures always involved in keeping dumps, as ordinarily made, free from obstruction to fresh additions thereto, and in maintaining said tracks in any fit condition for operation upon such dumps. In these ways, I provide a simple, efficient, flexible and economical apparatus for excavating, and a conveying apparatus for the excavated material equal to the demands of this powerful and speedy class of machines, requiring attendant plant of great flexibility and capacity for disposing of the materials excavated by them. The transversely operating excavator, traveling as described across and upon the bottom of the cut, together with the longitudinally traveling apparatus, form what I consider the best possible combination, especially for cuts of any considerable breadth.

The parts of my apparatus, while exceedingly efficient, are all simple and serviceable; they can be constructed with speed and facility, and are adapted, as perfectly as the parts of a well arranged manufacturing plant, to maintain at all times, on any particular piece of work, substantially the same relations to each other. In these ways I avoid defects inherent in the previous appliances and combinations with which I am acquainted; and therefore while I have described more or less precise forms of apparatus, I do not intend to unduly limit myself

thereto, but contemplate all proper changes in form and proportions, and the substitution of equivalent members as may be desirable or necessary.

I claim, continuing to use the term "excavator" with the restricted application hereinbefore indicated—

1. In an excavating apparatus a car or flat having an excavator mounted thereupon and adapted to swing to and operate upon each side of a central normal line of position, and trucks arranged under said flat to travel normally upon lines oblique or substantially transverse to said central line of operation of said excavator, substantially as described.

2. In an excavating apparatus, a structure with projecting sides off which excavated material can be dumped, and traveling alongside the cut, such structure being provided with an incline extending to the bottom of the cut and with at least one track upon such structure and incline, substantially as described.

3. In an excavating apparatus, a projecting structure traveling upon suitable tracks alongside of the excavation, such structure being provided with an inclined plane and apron extending to a point near the bottom of the excavation and one or more tracks supported upon and carried by such structure, inclined plane and apron, substantially as described.

4. In an excavating apparatus, the combination of two or more platforms supported upon wheels, preferably of gradually increasing diameters, and a track or tracks upon such platforms; whereby an inclined track or tracks is provided, substantially as described.

5. In an excavating apparatus, the combination of an excavator traveling upon and across the bottom of the cut in a direction transverse to the longitudinal direction of the cut, and supported by tracks and trucks thereupon, a structure terminating next the cut in an incline and provided with means whereby the material discharged from the structure shall not encroach upon the structure itself, and mechanism for receiving the material from the excavator and supporting it on its travel to and along said structure, substantially as described.

6. In an excavating apparatus, the combination of an excavator operating upon tracks at the bottom of the excavation, a structure traveling along the side of the excavation in front of the spoil or other bank and provided with an incline extended down into the cut, a track or tracks supported thereon, an inclined track mounted on platforms and traveling across the bottom of the excavation and connecting with the tracks on the incline, and cars traveling along such inclined track, whereby the excavated material is received from the excavator into the cars, hauled down the inclined track onto and up the incline, and onto and along said structure, and is dis-

charged out of the cars to form the spoil or other bank, substantially as described.

7. In an excavating apparatus, the combination of an excavator operating upon tracks at the bottom of the excavation, a structure traveling along the side of the excavation and provided with an incline extending into the cut, a track or tracks supported thereon, a track mounted on platforms and traveling across the bottom of the excavation and connecting by branches with the tracks on the incline, and cars traveling along such mounted

track, whereby the excavated material is received from the excavator into the cars, hauled along the mounted track and to the incline, thence up the incline onto and along said structure, and is discharged out of the cars to form the spoil or other bank, substantially as described.

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